

Overview

Acting Associate Lab Director's Perspective

DOE-NP Annual S&T Review of RHIC

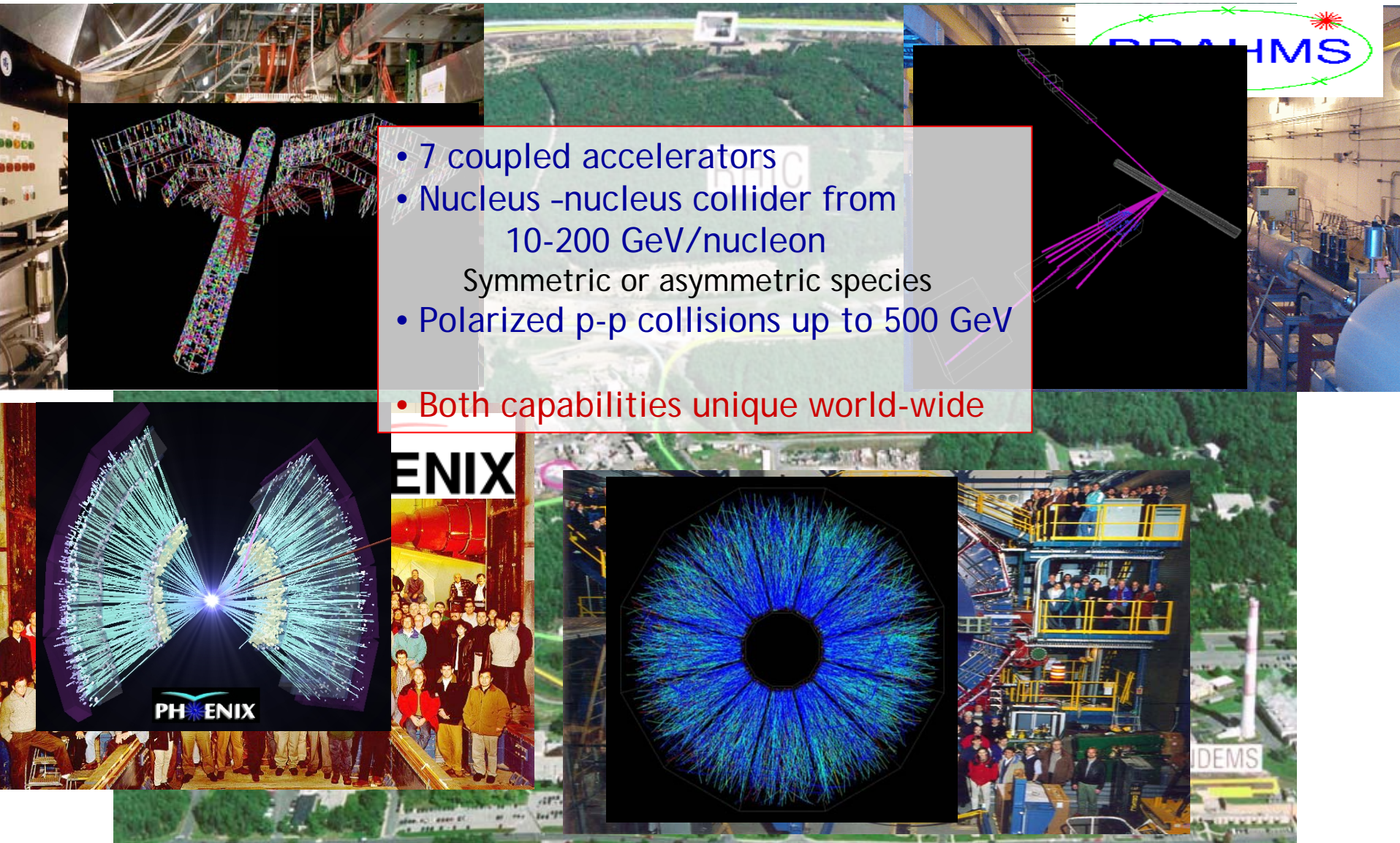
P. D. Bond

July 24-26, 2006



RHIC Overview

- 7 coupled accelerators
- Nucleus-nucleus collider from 10-200 GeV/nucleon
Symmetric or asymmetric species
- Polarized p-p collisions up to 500 GeV
- Both capabilities unique world-wide



Topics

- Organization and Reorganization
- Safety
- Core competencies at BNL
- Response to last year's review
- RHIC overview and the roles of BNL
- Accomplishments of the RHIC program
- Priorities, vision, outlook for the RHIC program

Structure of this Review

■ Monday Morning

- Laboratory perspectives, vision
- Collaboration reports, outlook

■ Monday Afternoon

- Accelerator performance, upgrades
- Lattice Gauge Theory, RHIC Computing Facility

■ Tuesday Morning Parallel Sessions

- A: Accelerator R&D, Superconducting Magnet Division
- B: BNL Research Program

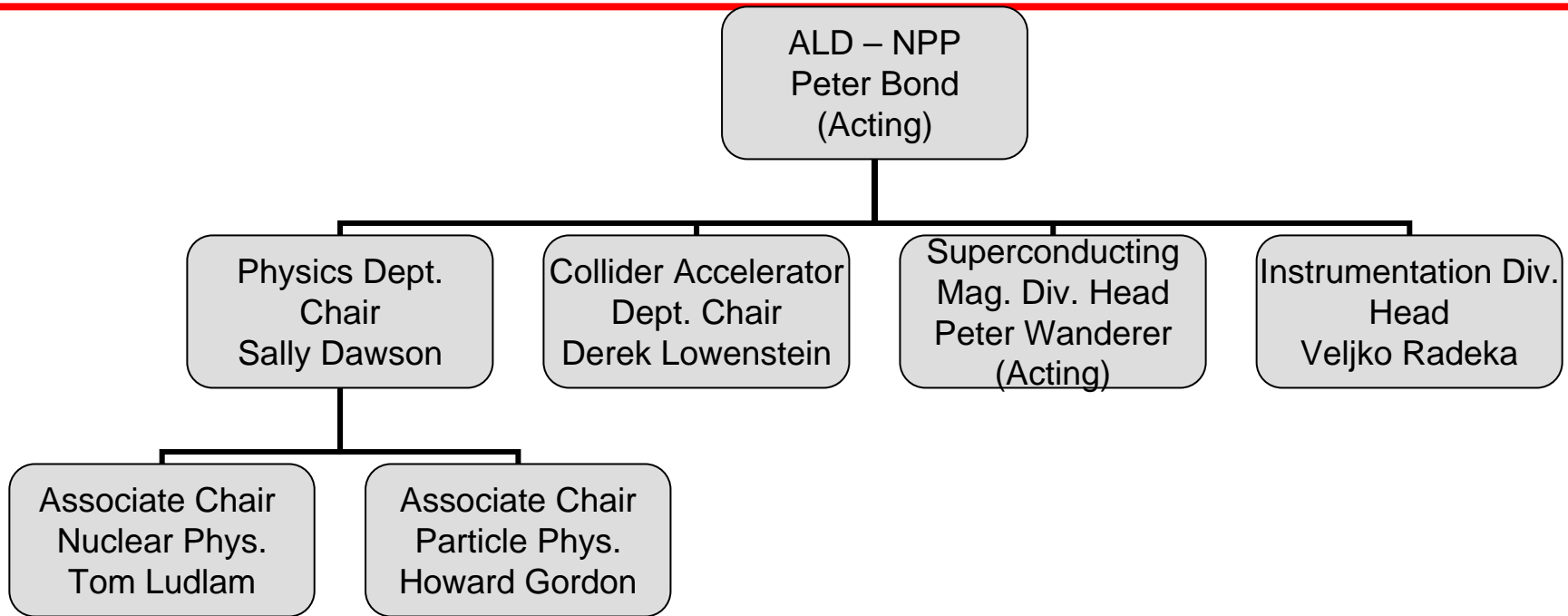
■ Tuesday Afternoon

- Safety, Theory program, Users' and PAC perspective

Value of the review to BNL

- S&T Review of the RHIC Program
 - but also BNL-specific performance in Research and Operations
- Evaluate typical problem of a host laboratory
 - Balancing research and “customer” support
- A key piece of this review for us -- how well do we achieve this balance ?
- Is our planning sensible and credible ?

Nuclear and Particle Physics Directorate



- NPP: 2 Departments, 2 Divisions, ~730 FTEs total (various funding types)
- PHOBOS in Chemistry (will move to Physics)
- Some non-RHIC NP-funded activities

LEGS, neutrino (Chemistry), NNDC (Energy Sci and Tech Dept)

- Total FY06 BNL NP Budget Authority ~\$147M (includes “landlord” funding - in addition this year \$13M private funding)

Reorganization

- The name of the Directorate has been changed to Nuclear and Particle Physics from High Energy and Nuclear Physics
- Sam Aronson appointed Interim Director on May 1 and I have taken over acting role of ALD for NPP
- With completion of PHOBOS and BRAHMS those groups have been downsized and reformed into a new group. Some effort devoted to STAR and PHENIX and some to proposed LHC HI effort.

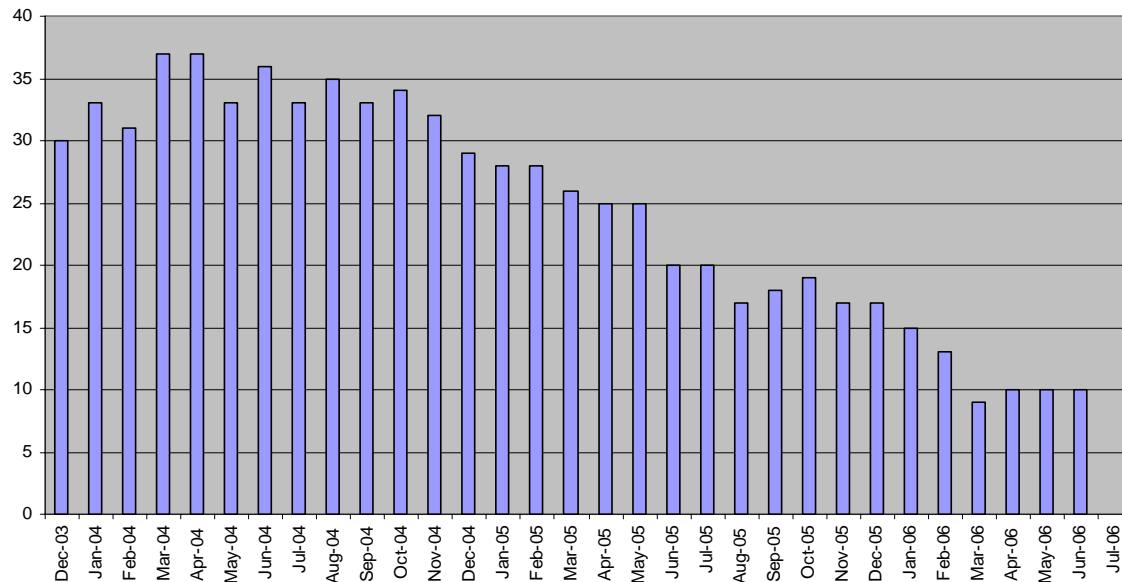
You will hear from this combined group
- There are two NP theory groups at the Lab - one focused on Lattice Gauge and one more broad ranging

You will hear presentations from each

Lab-wide Safety

- BNL has made steady improvement and has added a number of initiatives including supervisor work observation training to aid in continuing to reduce injuries (we still get a lot of “simple” cases)

Lab total 12 month rolling DART cases



Ed Lessard will talk about Directorate specific issues

Core Competencies at BNL

(from DOE business plan- bold relevant to RHIC program)

- Design, construct, and operate extraordinary facilities
RHIC/AGS, ATF (today and Session A)
 - Advanced concepts of accelerators, detectors, magnets, and instrumentation
SMD, CA-D (Session A), Instrumentation*
 - Synchrotron radiation science and technology
 - Imaging expertise
 - Tera (peta)-scale computing
RCF, QCDOC (today) , BlueGene on the way
- *Mentioned in this talk*
- *Recent BSA review of SMD highlighted unique capabilities for specialized magnets*

Last Year Issues

■ Action Items from last year's S&T Review

- BNL should make a choice between magnetized and non-magnetized beam cooling
 - Done - choice of non-magnetized and justified in response
- BNL should review utilization of RCF and develop and implement a plan to improve utilization
- BNL should prepare a 5-year plan for RCF in context of upgrades of RHIC and experiments
- BNL should develop a mid-term strategic plan that includes necessary upgrades in context of scientific priorities and turn on of LHC.
 - Done - these three items were addressed in a single document - hopefully satisfactorily - you will hear more detail in this review

RHIC Program Accomplishments

- Six spectacularly successful annual runs - this year partly due to Renaissance Technologies
 - Physics discoveries: a new state of matter (top physics story of 2005)
 - Scores of refereed papers, thousands of citations
 - Machine performance meeting and exceeding goals
- Large Au+Au sample (Run 4) being analyzed
 - Significant, and surprising, suppression and flow effects seen for heavy quark particles (via non-photon electrons)
 - First measurements of J/psi suppression at RHIC
- Large Cu+Cu (Run 5) being analyzed
 - Precise studies of jet suppression, flow, and hydro behavior vs. system size and shape
- Polarized p+p samples (Runs 5-6) being analyzed or in hand ---
 - First results from two-spin asymmetries indicate small value of ΔG (gluon spin contribution).

Detailed talks on all these today and breakout session

The Roles of BNL (Operations)

Operations

- RHIC has met and often exceeded expectations each year
 - Integrated luminosity with HI and polarized p
 - Proton polarization (this year 65% @ 100GeV/beam)
 - CM Energy scans (this year 200 GeV and 62GeV runs with tests at 22GeV and 500 GeV polarized p)
- Development continues with HI and polarized p and has plans for operations improvement, e.g.
 - EBIS
 - Currently have CD-1 - CD-2 later this year
 - NYS: Empire State Development Corp funds are expected to be available for infrastructure enhancement for EBIS
 - Continually evaluate operations efficiency
- BNL plays major role in detector operations

The Roles of BNL (Research)

Research

- HI research reviewed in 2004 with other labs
 - Very productive, leading groups in their collaborations
- Nuclear Theory (2005) and Spin groups (2006) were reviewed in comparison with other labs
 - Synergy with RIKEN BNL Research Center (RBRC - 10th anniversary): one of two major positive impacts of participation in RHIC from Japan (also US/Japan program)
 - Theory quality outstanding, but some concern with perception of “relevance” to experimental program and DOE goals - we have discussed these issues with DOE
 - Spin report expected within a month
- BNL plays key roles in research *and* detector operations

Forefront experimental and theoretical research at BNL is vital to outstanding operations at RHIC

Ongoing Instrumentation Division Activities for RHIC

S = 1-2 years; M = 3-5 years; L = \geq 5 years

Silicon Detectors

Time Scale:

- Vertex detectors
 - *low mass Monolithic Active Pixel Sensors (MAPS)* M-L
- PHENIX (RIKEN, spin physics)
 - *single sided 2d strip detectors* S-M
- For all polarimeters (CNI and H-jet) at AGS/RHIC
 - *thin window and large thickness detectors* S-M

Gas Detectors

- *Small fine grained ("Micro") TPCs* M-L
- *Gas Electron Multipliers* M-L

Microelectronics

- *Fine-grained detectors (TPCs, etc.)* S-M-L
- *FPGA & DSP technology* S-M-L

RHIC Beam Monitoring

- *Digital Signal Processing - continuing development*

Photocathodes

- *Electron cooling at RHIC* M
- *eRHIC, GaAs \rightarrow polarized electrons* L

The Roles of BNL (Planning)

Scientific program planning

- Planning on all time scales with full community participation:
daily, weekly meetings...annual, decadal and 20-yr plans
 - Beam Use Proposals → Program Advisory Committee (you will hear from PAC Chair)
 - Running time (including split among energies & species);
- **Balancing of resources: running vs. investments**
 - Experiment and machine upgrades
 - Experimental support (including RCF & Infrastructure);
 - AIP; R&D
- **Budget Planning Spreadsheet co-maintained with DOE-ONP**

Mid Term Plan (~5 years)

- Following last year's review BNL submitted a mid term plan that was vetted by PAC
 - T. Ludlam will present details
- EBIS replaces Tandems (more ion species, lower cost)
- e-cooling being implemented to increase luminosity by factor 10
- STAR and PHENIX upgraded to enable rare probe experiments stimulated by early RHIC results
- Computing power (e.g. BlueGene/L) is added to allow more powerful theory calculations

Longer Term Plan

Evolve RHIC into a more comprehensive QCD laboratory

- A 10GeV electron accelerator is added to RHIC
- A new detector is added

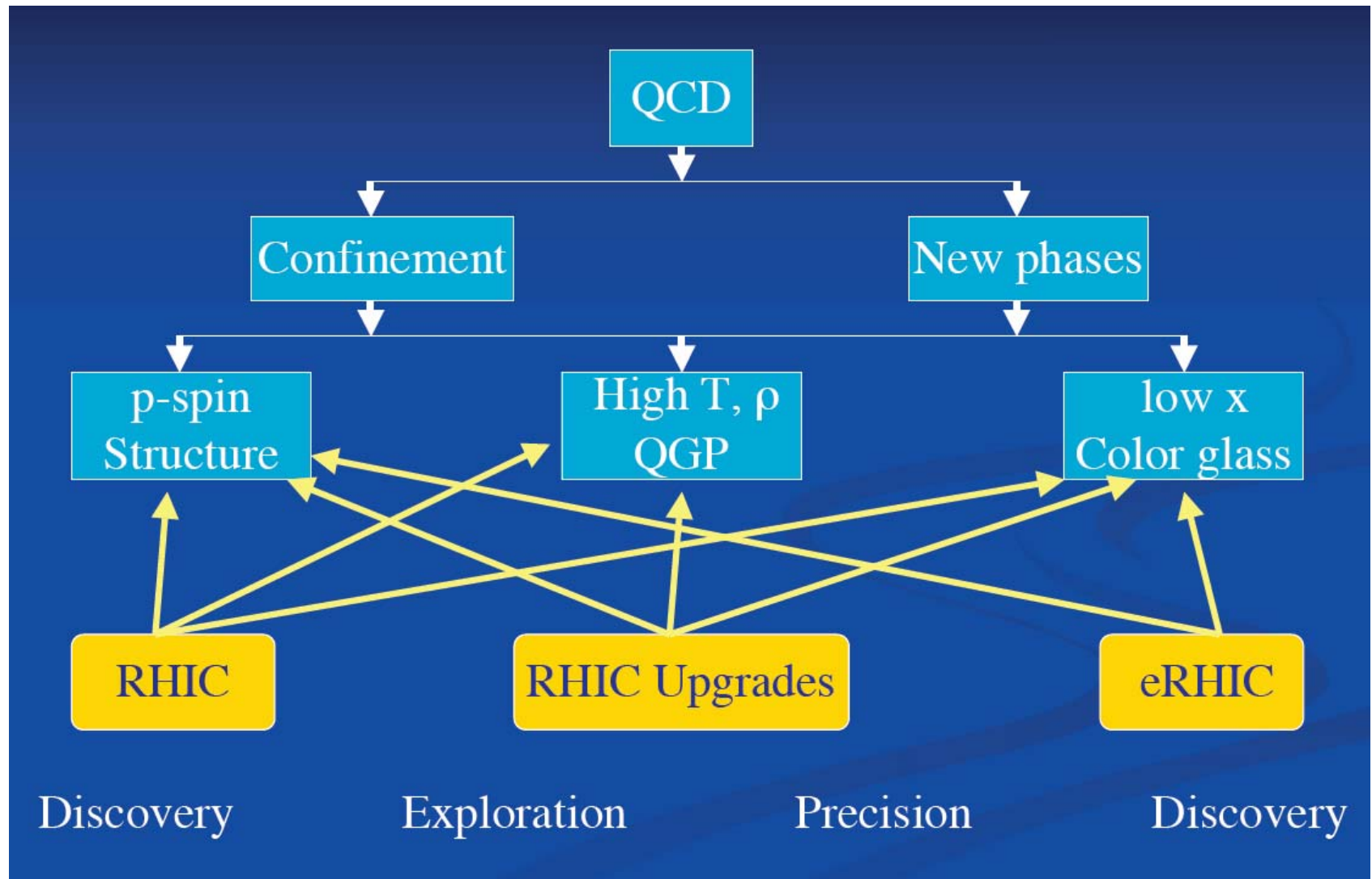
Address the compelling questions in QCD revealed by the discoveries at RHIC - the steps

- Involve the RHI, Spin and DIS communities in articulating the future science of RHIC and eRHIC
- convince the Nuclear Physics community of the outstanding science afforded by

$$A + A, p + A, \vec{p} + \vec{p}, \vec{e} + \vec{p}, e + A$$

- address the technical, funding and political issues

A future look of QCD at BNL



Summary

- RHIC's success has made BNL a world center for
 - Heavy Ion Physics
 - Spin Physics
 - Nuclear Theory (high T , high ε , high E , low x)
 - Accelerator science
- Compelling mid-term program for science
 - New detector capabilities, higher luminosity and polarization
- A clear (*non-trivial*!) path leading to a broad ranging QCD laboratory

This path has *discovery potential* every step of the way!